IN THE SPECIFICATION:

Please see the Substitute Specification filed concurrently herewith.

METHOD AND CIRCUIT ARRANGEMENT FOR MONITORING AND CONTROLLING THE TRANSMISSION CAPACITY OF A DATA TRANSMISSION PATH

CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/02240 which was published in the German language on February 1, 2001.

TECHNICAL FIELD OF THE INVENTION

The invention relates to a method and a circuit arrangement for monitoring and controlling the transmission capacity of a data transmission path which exists between two data devices.

In one embodiment of the invention, the transmission capacity of the primary channel of a data transmission path is monitored between two data devices such that a requirement for additional transmission capacity for a data signal transmission which is to be carried out can be determined at an early stage, and hence even before data signal transmission, in order to avoid overloading. That is, a secondary channel can be connected in good time.

BACKGROUND OF THE INVENTION

In cases involving connection of a secondary channel initiated by one of the data devices, situations can occur in which the relevant connection can be initiated only after the two data devices have been made aware of this by means of appropriate communication, which is handled via the primary channel.

However, in this context, a situation can arise in which the relevant connection, for example transmitting a large amount of data, is urgently required and, at the same time, the primary channel is already overloaded. Overload is typically a result of a large

amount of data being transmitted and/or since channel capacity has been reduced owing to external influences, which are not under the control of the data terminal. In this case, any communication which is required before the initiation of a connection of the secondary channel between the data devices can not take place, or can take place only with a major delay, so that the urgently necessary connection of the secondary channel cannot take place, or can take place only with a major delay. This then makes the data transmission and the channel utilization very inefficient.

One such method is known, for example, in conjunction with the transmission of data signals between an ISDN basic access point and a selection node into a network which, as an IP-based network, that is to say a network operating on the basis of an Internet protocol, allows access to the Internet or to an Intranet. The method is described in the document "Always On/Dynamic ISDN" by A. Kuzma, Intel Corporation, October 1997, which has been published by the Vendors' ISDN Association on the Internet at http://ww.via-ISDN.org/. This document also describes the measures considered above, which allow data transmission via a data transmission path between a computer or personal computer which is associated with the ISDN basic access point and is also referred to as an AO/DI client (Always On/Dynamic ISDN), and a selection node into the IP-based Internet or Intranet. Such a selection node is also referred to as an AO/DI-PoP (Always On/Dynamic ISDN-Point of Presence).

With regard to the data transmission path having a relatively low transmission capacity, it should be noted that the data transmission path is generally used not only for a connection between one computer (or personal computer) and a selection node but also at the same time used for a number of such connections, to be precise on a time division basis. With regard to the data signal transmission channels which are available

in this way, the expressions logical channels or SVC channels (Switched Virtual Circuits) are also used.

Data signal transmission channels of this type are formed in integrated service digital networks (ISDN) within auxiliary channels of a channel arrangement which comprises auxiliary channels and user channels. In the case of an ISDN communications network, which has already been in use for a long time, the auxiliary channel (referred to as the D channel) has a transmission capacity of, for example, 16 kbit/s. The relevant channel arrangement has at least one user channel, but normally two user channels each having a transmission capacity of 64 kbit/s.

EP-A-0 905 998 discloses the transmission of signals, in particular data signals, via an ISDN transmission path between terminals and the Internet. The ISDN transmission path comprises a D channel, which is used as the primary channel, and two B channels, which are used as secondary channels. To allow the primary or D channel to be used appropriately for data signal transmission, this channel must have an adequate transmission capacity and hence bandwidth. In order to find out whether such a transmission capacity and hence bandwidth are available, quality monitoring packets, which represent test signals, are transmitted either at specific times or periodically between an access server, which connects the ISDN transmission path to the Internet, and a switching center, which is connected to the relevant terminals, via said primary channel. These quality monitoring packets each have a timestamp which makes it possible in the switching center or in the access server to determine the delay time which the respective quality monitoring packet has experienced in the course of being transmitted via the primary channel. If this delay time, which is dependent on the load on the relevant primary channel, exceeds a specific threshold value, the respective terminal which

is connected to the switching center is requested to reduce the bandwidth previously used in the primary channel. That is it is requested to operate with a narrower bandwidth. However, the individual terminal does not have any capability to determine the available transmission capacity, and hence the bandwidth, of the primary channel. However, it is possible to calculate the bandwidth required for a data signal transmission which is to be carried out by a terminal on the basis of the IP packets to be transmitted, in order to use not only the primary channel (D channel) but, possibly, also a secondary channel (B channel) for the relevant data signal transmission. However, neither are any test signals transmitted via the relevant primary channel, nor are their transmission times evaluated, for this process.

A method and an apparatus for determining and taking account of overload situations in a telecommunications switching system are also disclosed, in which the switching center having a central processor for controlling certain operations of the switching center, and having subscriber access line groups and connecting line groups which are connected to the central processor in US-A-4.511.762. A switching network is connected to the central processor and to the subscriber access line groups and connecting line groups, and this can produce connections between the various subscriber access lines and connecting lines.

If the connecting lines and/or the subscriber access lines are connected to one another, then a message is transmitted to the central processor in the switching system whenever a communication is made via the connecting lines and/or the subscriber access lines and, in addition, an acknowledgement is emitted to the respective line group in response to the relevant message. The finding that the system is overloaded is based on determination of the time after which the

central processor receives a response signal to the message. In this case, the respectively measured time is compared with at least one specific threshold value, in order to determine whether the system is overloaded. Even in this case, subscriber circuits which are connected to the individual subscriber access lines generally cannot determine the respectively available transmission capacity from these connection circuits.

SUMMARY OF THE INVENTION

In one embodiment of the invention, the transmission capacity of the primary channel of a data transmission path is monitored between two data devices such that a requirement for additional transmission capacity for a data signal transmission which is to be carried out can be determined at an early stage, and hence even before data signal transmission, in order to avoid overloading. That is, a secondary channel can be connected in good time.

In one aspect according to the invention, the delay time is determined in that, in response to the emission of the test signals, a response signal is sent back from at least one of the two data devices via the primary channel of the data transmission path to the other data device in response to the reception of the relevant test signals, to the first data device via the primary channel of the data transmission path, which response signal either comprises the respective test signal itself or is a separate signal initiated by it. The time interval between the transmission of a test signal by the first data device and the arrival of a response signal which is sent back to it from the other data device is compared with a predetermined threshold value time, which corresponds to a specific current transmission capacity of the primary channel of the data transmission path, forming a comparison result, in response to which a transmission capacity signal is formed, which corresponds to this result and which can

be used to activate at least one secondary channel for signal transmission. The monitoring of the transmission capacity is carried out deliberately, before transmission of the relevant data, when an amount of data is present which exceeds a defined amount threshold value and is to be transmitted by the first data device to the other data device. The time of the start of deliberate monitoring of the transmission capacity of the data transmission path is used as the point of origin for regular monitoring of the transmission capacity of the relevant data transmission path at time intervals of t.

No further deliberate monitoring of the transmission capacity of the data transmission path is carried out in a situation in which the time period which has passed since the last monitoring of the transmission capacity is shorter than a defined time period.

One advantage of the invention is that the transmission capacity on the data transmission path can be monitored relatively easily, so that appropriate measures can be taken by the respective data device on the basis of the monitoring result available there and which can indicate, in particular, that the primary channel is overloaded. These measures mean that, in a situation where the transmission capacity signal indicates that the data signal transmission path is overloaded, the relevant data device requests additional transmission capacity in response to the transmission capacity signal. In the case of the channel arrangement at the ISDN basic access point, the additional transmission capacity can then be provided by requesting at least one user channel or B channel in addition to the primary channel or D channel which has already been used for the data signal transmission, for data signal transmission as a secondary channel, and by also using this for data signal transmission.

Thus, according to one embodiment of the invention, overloading of the data transmission path which is being used can be identified at an early stage, and suitable measures, in particular the connection of a secondary channel, can be initiated immediately. If communication between the terminals via the primary channel is required to do this, then this can thus be carried out before the already overloaded primary channel is also loaded still further by the transmission of data.

It is thus advantageously possible, even before data signal transmission, to determine whether the transmission capacity which is available for transmission of the relevant data signals on the data transmission path is adequate to avoid overloading. If it is found that the data transmission path will be overloaded when transmitting the data signals which are present, then the first data device can thus request additional transmission capacity before the relevant data signal transmission, thus ensuring problem-free data signal transmission.

Apart from this, an aspect of the invention ensures that the data transmission path which is normally used for data signal transmission is not unnecessarily loaded by deliberate monitoring immediately following regular monitoring, but can be used virtually immediately for data signal transmission.

Finally, a sensible transition can be made from deliberate monitoring to regular monitoring of the transmission capacity of the data transmission path so as to avoid two monitoring processes occurring unnecessarily at a short time interval after one another.

The transmission of the respective test signal preferably activates a timer which emits an output

signal once a defined time interval has elapsed, which output signal, if it occurs before the arrival of the response signal, causes a transmission capacity signal to be emitted which indicates an overload state on the data transmission path. This measure advantageously means that overloading of the data transmission path can even be identified in a situation in which no such response signal arrives at all, or such a response signal arrives only at a time such that the time interval between the transmission of a test signal and the arrival of a response signal sent back in response thereto is greater than the threshold value time mentioned above.

Those signals which are associated with a communication between the two data devices, which is necessary for connection of a secondary channel, are expediently transmitted at the earliest possible time, that is to say, in particular with priority over the transmission of the data which is present. This procedure has the advantage that the time period between identification of the requirement for a secondary channel and the connection of this channel is not unnecessarily lengthened.

In an integrated service digital network (ISDN), in which a switched virtual channel (Switched Virtual Circuit), which in places runs within a D channel, as the primary channel, and at least one B channel is used as the secondary channel, message signals based on a bandwidth allocation protocol are used for allocating the bandwidth and transmission capacity to be used before setting up a B channel, and are transmitted with priority over the other data. Efficient data signal transmission can thus be carried out in an advantageous manner between the two the data devices in an integrated service digital communications network. Signals from an existing bandwidth allocation protocol can thus easily be used here.

The message signals EchoRequest and EchoReply of an Internet link control protocol are expediently used as the test signal and response signal, respectively. This results in the advantage that it is possible to use signals in accordance with a transmission protocol which is used in any case.

In order to carry out the method according to an aspect of the invention, it is possible to use a circuit arrangement wherein at least one of two data devices which are connected to one another via a data transmission path has an associated monitoring device, which allows a time comparison to be carried out between a measurement time interval from the emission of a test signal from the relevant data device to the other data device until the arrival of a response signal from this other data device with a predetermined threshold value time. Further, the relevant monitoring device can emit a transmission capacity signal which corresponds to the respective time comparison result. A report signal can indicate an overload state on the data transmission path if the measurement time interval exceeds the relevant threshold value time.

This circuit arrangement is distinguished by the advantage of particularly low circuit complexity.

A timer is expediently connected to the monitoring device, can be activated by the test signal, and, emits an output signal to the relevant monitoring device once its operating time, which corresponds to an overload state of the data transmission path has elapsed. The monitoring device uses this output signal, if the response signal from the other data device has not yet arrived, to emit a report signal which indicates the overload state of the data transmission part. This ensures, with particularly low circuit complexity, that overloading of the data transmission path can be

identified even in a situation in which the response signal does not arrive at all, or arrives only at a time such that the time interval between the transmission of a test signal and the arrival of a response signal sent back in response to it is greater than the threshold value time mentioned above.

Before explaining the invention further with reference to an example, it should first be noted that the method according to an aspect of the invention has a specific application in an integrated service digital network, a so-called ISDN, as is specified by the ITU-T Series 1 Recommendations. In this case, a so-called D channel with a maximum of 16 kbit/s and two B channels each having 64 bit/s are available at a so-called basic access point (for connection of up to eight terminals to the network). A permanent connection between the basic access point and the network is produced via the D channel, to be more precise a connection to a network node which is suitable for this purpose, and is referred to as a local exchange. This is used firstly for interchanging messages between terminals and the local exchange, while, it also makes it possible to set up and operate a virtual channel, a so-called SVC channel (Switched Virtual Circuit) for data transmission to another terminal connected to the network. The B channels are used when required; initiated by a terminal connected to the basic access point, these B channels are connected to other network subscribers selected by the initiating terminal.

In the method according to an aspect of the invention, the SVC channel can be used as the primary channel between two data devices; the B channels can be used as secondary channels. The capacity of the SVC channel is, in this situation, naturally restricted to a value of less than or equal to 16 kbit/s. However, normally, there is no way in which this maximum capacity can be offered simultaneously to all the basic access points

to a local exchange, since a large number of SVC channels occur, at least in places, on lines which are used jointly in a multiplexing mode. This generally takes place in the local exchange itself, and also on further sections of the route of the respective SVC channel in the network. The bandwidth available for each SVC channel thus depends not only on the utilization of the relevant SVC channel by the two terminals which it connects, but also on the influence of other stream of traffic.

The method which has been mentioned above and which is entitled "Always On/Dynamic ISDN" (AO/DI, for short), and which has been described in the document with the same title cited above by A. Kuzma, Intel Corporation, October 1997, is now used in conjunction with data signal transmission in an integrated service digital network. In this case, a client, generally a personal computer connected to an ISDN basic access point, and a PoP (Point of Presence), which is likewise connected to the ISDN (but is also on the other hand connected to the Internet or to an Intranet and is used to provide clients with access to the Internet or to an Intranet) are used as data devices in the method described above. An SVC channel is used as the primary channel, in which case at least one additional B channel can be set up as a secondary channel, when required, after previous negotiation between the client and PoP.

A range of protocols which have been standardized by the IETF (Internet Engineering Task Force), in particular the "Link Control Protocol" (LCP) and the "Bandwidth Allocation Protocol" (BAP), are used for communication purposes with the AO/DI procedure. The LCP protocol message signals "EchoRequest" and "EchoReply" can, as stated above, be used as a test signal and response signal, respectively, for the method according to an aspect of the invention. The BAP protocol message signals are used to handle the

connection of additional B channels; they are thus those message signals which may be given priority over an existing data transmission in the method according to an aspect of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be explained in more detail with reference to an exemplary embodiment, which is illustrated in a drawing.

Fig. 1 is a schematic drawing of a subscriber point SUB in a communications network.

DETAILED DESCRIPTION OF THE INVENTION

In the present case, is an ISDN basic access point. The relevant subscriber point is connected to a switching device in the relevant communications network by means of a range of equipment, and via a connection circuit COC.

The illustrated equipment includes a telephone terminal TEL, a facsimile or fax terminal FX, and a home or personal computer PC. Of these items of equipment at the subscriber point SUB, which are all connected to the connection circuit COC which is, for example, a network termination circuit (a so-called NT circuit) in the ISDN communications network, only the home computer or personal computer PC in conjunction with communications links is significant in the following text. In conjunction with the connection circuit COC, this personal computer PC in this case represents a data device, between which and another data device (a further device), which is still to be considered, data signals can be transmitted.

The connection circuit COC is connected via a range of connecting channels B1, B2 and D to an exchange device, of which only an associated switching device SW is indicated in the present case. A selection node POP,

which represents the already mentioned further data device, may be connected via a range of connecting channels BCH to the switching device SW in the above-mentioned communications network. This selection node POP makes it possible to produce a connection, and to communicate with so-called IP-based networks, i.e., networks in which connections can be set up, and data signals can be transmitted, on the basis of an Internet protocol. These networks are indicated as an IP network in Fig. 1.

The switching device SW and the selection node POP are connected via a packet handling device PHD. The packet handling device PHD may be connected via connecting lines TL1 and TL2 to the switching device SW and, respectively, to the selection node POP.

A circuit arrangement in the connection circuit COC is shown in the form of a detail, and this circuit arrangement is used to monitor, and possibly to control, the transmission capacity of a data transmission path which exists between the first data device or the personal computer PC and the other data device POP. In this case, this data transmission path is formed by an SVC channel as the primary channel in the D channel, and, furthermore, on the connecting lines TL1 and TL2, in addition to which at least one user channel (B channel) can also be used as a secondary channel in a situation in which the communications network, which includes the switching device SW, is an ISDN network. Based on the relationships illustrated in Fig. 1, the above-mentioned channel arrangement contains two user channels B1 and B2. The connecting lines TL1 and TL2 are available, as stated above, for a number of data signal transmissions which take place virtually at the same time, so that its transmission capacity and bandwidth can be used for more than one such transmission.

The above-mentioned circuit arrangement, which is contained in the connection circuit COC, includes a signal generator SIG, which can be actuated by the personal computer PC via a connecting line L1, in order to output an output signal corresponding to the respective actuation and in response thereto. As will also be seen from the following text, the relevant output signal may be a test signal or some other command or request signal, which is initiated by the personal computer PC. This will be described in more detail in the following text.

On the output side, the signal generator SIG is first connected via a connecting line L2 to one input IN1 of a processing circuit PRC and then to one input of an OR circuit OG, which is connected on the output side to one input A of a splitting circuit COM. This splitting circuit COM is connected by a separate output B to one input IN2 of the processing circuit PRC. The relevant splitting circuit COM is connected by a connection C, which is used as an input/output connection, to the channel D, which is associated with the data transmission path, and to the connecting lines TL1 and TL2, which are likewise associated with the data transmission path, this channel D being referred to hereafter as the primary channel. At this point, it should be noted that the splitting circuit can be operated such that it allows data signals supplied to its input connection A to be passed to the connection C and, via this connection C, to be supplied to the primary channel D, such that it allows data signals supplied from the channel D to the relevant connection C to be passed to the output connection B.

A connecting line L3, via which data signals can be output from the personal computer PC, is connected to a further input of the above-mentioned OR circuit OG.

Furthermore, the input side of a timer TIM is connected to the above-mentioned output line L2 from the signal generator SIG. On the output side, the relevant timer TIM is connected to one input IM3 of the processing circuit PRC.

In addition to the above-mentioned inputs IN1 to IN3, the processing circuit PRC also has two further inputs IN4 and IN5, to which signals which are used for comparison purposes are supplied via respective connections T1 and T2. The connection T1 is in this case supplied with a comparison signal which is characteristic of a threshold value time, and the connection T2 is supplied with a signal which is characteristic of a defined time period, whose time duration - as will be explained in the following text - is regarded as not yet being overloaded with regard to the transmission capacity of the data transmission path formed by the primary channel D, TL1, TL2.

In the present case, the processing circuit PRC contains three outputs, which are annotated OV, TCA and DAC, and to which respective control lines L4, L5 and L6 are connected. An output signal, for example, a "1" signal, is produced at the output OV of the processing circuit PRC when - as will be seen from the following text - it is determined that the channel D, which forms the data transmission path, is overloaded. An output signal is produced at the output TCA of the processing circuit PRC, which indicates the provision or allocation of a further transmission capacity which can be used in addition to, or instead of, the transmission capacity of the primary channel D, TL1, TL2. Finally, data signals are produced at the above-mentioned output connection DAC of the processing circuit PRC which, from the point of view of the connection circuit COC, are supplied in the incoming transmission direction from the other data device POP via the packet handling device PHD, the switching device SW and the splitting

circuit COM, to the connection circuit COC via its processing circuit PRC, in order to be passed on to the personal computer PC.

Now that the construction of the circuit arrangement illustrated in Fig. 1 has been explained, a method according to an aspect of the invention, and which can be carried out by the circuit arrangement under consideration, will now be explained.

In order to monitor the transmission capacity of the data transmission path, which includes the above-mentioned primary channel D, TL1, TL2, for data signal transmission between the devices which form the first data device, that is to say in this case the personal computer PC and the connection circuit COC, and the other data device POP, separate test signals are in principle emitted regularly, at time intervals of T, from the relevant first data device to the other or further data device POP. These test signals, which can each, for example, be formed by a so-called ECHO-REQUEST signal corresponding to the protocols used in IP-based networks, are in this case either produced by the personal computer PC itself and are output via the D channel to the other data device POP and, in the process, are, so to speak, passed through the signal generator SIG, or they are output from this signal generator SIG in response to a corresponding command actuation from the personal computer PC. As mentioned above, the relevant test signals pass via the primary channel D, TL1, TL2 and the switching device SW to the packet handling device PHD, which then passes these test signals to the other data device POP. This process can take place in the course of a packet-oriented switching process, as is actually also the case in the ISDN communications network which has been presupposed as an assumption.

On receiving such a test signal, the other data device POP now causes either the respective test signal itself to be passed back via the transmission path, that is to say the primary channel D, TL1, TL2, to the first data device (PC, COC) once again, or else causes a separate response signal, which is triggered by the respective test signal, to be transmitted back to the relevant first data device. By way of example, this separate response signal can be formed by a so-called ECHO-REPLY signal, corresponding to the protocols used in IP-based networks. In this case, the relevant response signal arrives more quickly at the data device the greater the transmission capacity or bandwidth of the primary channel D, TL1, TL2 being used.

In the present case, the time interval between the transmission of a test signal and the arrival of a response signal, which is sent back from the other data device POP in response to this test signal, is now compared in the processing circuit PRC with a predetermined threshold value time which corresponds to a specific transmission capacity of the data transmission path, that is to say of the primary channel D, TL1, TL2. In order to determine this time interval, which represents a measurement time interval, a counter which is contained in the processing circuit PRC, for example, starts to count in response to the actuation of the input IN1 of the processing circuit by a test signal. The relevant counter stops its counting process when a response signal arrives at its input IN2. A signal which corresponds to the time interval determined in this way can then be compared with a signal which corresponds to the threshold value time, and is supplied to the connection T1.

The comparison of the measurement time interval with the threshold value time is used to form a comparison result, in response to which a transmission capacity signal, which corresponds to this result, is formed. In

the present case, in particular if it is found that the measurement time interval is greater than the threshold value time, the output OV of the processing circuit PRC produces a report signal which indicates that the data transmission path, that is to say the primary channel D, TL1, TL2, is overloaded. In response to this report signal, the first data device, that is to say the personal computer PC, can decide to request additional transmission capacity for a planned data signal transmission. This additional transmission capacity can then no longer be provided on the data transmission path formed by the primary channel D, TL1, TL2, and at least one of the still existing user channels B1, B2 may be used for this purpose as a secondary channel, which in this case passes over a different route than the primary channel. This secondary channel can then be used for data signal transmission instead of, or in addition to, the primary channel which was previously provided for data signal transmission.

The above-mentioned timer (TIM) is provided in order to obtain a report signal which indicates that the data transmission path, that is to say the D channel and the connecting lines TL1, TL2, is overloaded even in a situation where the other data device POP does not emit any response signal, or such a response signal is emitted, and is received at the first data device (PC, COC), only after a longer time than the threshold value time. In response to being actuated by a test signal, and once a defined time interval has elapsed, this timer TIM emits an output signal which causes the report signal, which indicates that the data transmission path D, TL1, TL2 is overloaded, to be emitted before the arrival of a response signal from the other data device POP. In this case, a signal which corresponds to the relevant defined time interval of this timer TIM can be compared with the threshold value time, with the time interval of the timer TIM being such that it corresponds precisely to a defined

specific load state, and hence transmission capacity, of the data transmission path D.

The described test of the transmission capacity is carried out at regular time intervals.

In order to avoid starting data signal transmission before adequate transmission capacity is available when an amount of data or data signals exceeding a predetermined amount threshold value is intended to be transmitted from the personal computer PC of the first data device to the other, that is to say the second, data device POP and for whose transmission, for example, it is desirable to have a transmission capacity as is at least provided by the predetermined specific transmission capacity mentioned in the time comparison considered above, the transmission capacity of the data transmission path, or of the primary channel D, TL1, TL2, can preferably be monitored before these data signals are transmitted. This can be done by the first data device PC once again transmitting a test signal, in response to which the other data device sends back a response signal. The time interval between the transmission of the test signal and the arrival of the response signal in the relevant first data device, or in the connection circuit COC associated with it, is then compared with the threshold value time in order to derive, from the difference between these times, a transmission capacity signal which is used to decide whether additional transmission capacity should be requested.

If the time period which has passed since the last time that the transmission capacity was monitored is shorter than a defined time period, then the transmission capacity of this primary channel D, TL1, TL2 is not deliberately monitored once again. In this case, the time of starting such deliberate monitoring of the transmission capacity of the relevant primary channel

D, TL1, TL2 can be used as the time of origin for regular monitoring of the relevant transmission capacity at defined intervals of T. This then results in a changeover to the fundamental method, considered above, of regular transmission capacity monitoring.

If a major load on or overloading of the primary channel D, TL1, TL2 between the first data device (PC, COC) and the other data device POP is found, then the first-mentioned data device immediately transmits to the second-mentioned data device POP, via the relevant primary channel D, TL1, TL2, only such a message signal, on the basis of which the second-mentioned data device POP supplies to the first-mentioned data device PC an indication signal which indicates the provision of additional transmission capacity, is sent immediately. These signals, which, for example, can be formed by a so-called CALLBACK-REQUEST signal or CALL-REQUEST signal corresponding to the protocols used in IP-based networks, are in this case transmitted with priority over other signals which are to be transmitted via the primary channel D, TL1, TL2. This makes it possible to avoid delays which could otherwise occur in the transmission of such signals, so that the additional transmission capacity required for the data signal transmission to be carried out can be provided quickly, to be precise by allocating one or more of the user channels B1, B2, which represent secondary channels, for the data signal transmission. These secondary channels can then be used instead of the primary channel or, possibly, also in addition thereto, for data signal transmission.

The previously mentioned message signal which is transmitted from the first data device (PC, COC) to the other data device POP makes it possible to carry out a procedure, which may include a number of transmission processes, between these data devices for issuing and allocating additional transmission capacity for the

planned data signal transmission. In this case, such additional transmission capacity can, however, be allocated to the first data device only if it is available at that time and, possibly, also only if it is urgently required.

The method which is carried out according to an aspect of the invention for monitoring the transmission capacity of a data transmission path which exists between two data devices, that is to say the primary channel D, TL1, TL2, has been explained above with reference to a circuit arrangement which is essentially included in a connection circuit COC which is associated with the first data device. However, it is possible, without any problems, for the functions of this circuit arrangement also to be contained in the personal computer PC of the relevant data device, so that all the monitoring and control procedures that have been described above can in practice be handled by this personal computer PC. The connection circuit COC then acts only as a network termination appliance, as is used as an NT access appliance in ISDN switching systems.

Furthermore, the invention for monitoring the transmission capacity between two data devices has been explained only in terms of its application to the first data device which, in the exemplary embodiment under consideration, is formed by the computer PC and by the connection circuit COC which interacts therewith. However, the invention can also be used in a corresponding manner or even in addition to and/or by the other data device, the selection node POP. In principle, the present invention can thus be used in or by at least one of the two data devices under consideration.

Abstract

Method and circuit arrangement for monitoring and controlling the transmission capacity of a data transmission path

In order to monitor and, possibly, to control the transmission capacity of a data transmission path which exists between two data devices, at least the first data device regularly or deliberately transmits test signals via the data transmission path to the other data device, which then sends back response signals. The time interval between the transmission of a test signal and the arrival of a response signal is compared with a threshold value time, with the comparison result being used to form a transmission capacity signal which, in particular if the time interval exceeds the threshold value time, is a report signal which indicates overloading of the data transmission path.